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RESEARCH ARTICLE

Invasive alien plants in Sergipe, north-eastern Brazil

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Abstract
Biological invasions are considered one of the greatest threats to global biodiversity. In addition, they cause substantial economic impacts. However, studies about the subject in Brazil are still scarce. The aim of the present study was to prepare an inventory of non-native flora with invasive potential from Sergipe, Brazil. The inventory was carried out along the entire length of the sites. The species with potential invaders were grouped according to the biome/ecosystem and classified according to their habit and origin. Eighty-five species with invasive potential were sampled, 43 in the Caatinga, 75 in the Atlantic Forest, 36 in Sandbank and 22 in Mangrove. From these species, 17 were inventoried in all the biomes/ecosystems and 36 were observed in only one of them, six in the Caatinga, 27 in the Atlantic Forest and three in Sandbank. The number of potentially-invasive species sampled in Sergipe is alarming. The present study showed nearly twice the species listed by other authors for the entire northeast Brazil. This high number of taxa may be a consequence of facilitating the transfer of these species and the conservation conditions of the ecosystems studied in Sergipe. Another very worrying factor is that many of the species sampled are extremely aggressive and cause a series of impacts.

Keywords
Checklist, environmental impacts, floristic survey, invasive exotic

Introduction

Biological Invasions (BI) are considered one of the greatest threats to global biodiversity (Williamson 1996; Westbrooks 1998; IUCN 1999; Ziller 2001; Andrade et al. 2010; Zenni and Ziller 2011; Fabricante and Siqueira-Filho 2012). The BIs occur when a non-native species is able to adapt, reproduce and disperse to different locations in the area of initial introduction, establishing and invading new regions (Richardson et al. 2000; Moro et al. 2012). The invasive exotic species have the ability to alter the structure of communities, inhibit the regeneration of native species, cause interference in the nutrient cycling, water balance, productivity, succession processes and biological diversity (Pujadas 2001; Lockwood et al. 2007; Ziller and Zalba 2007; Andrade et al. 2009; Oliveira-Costa and Souza 2015; Santos and Calafate 2018).

There are some hypotheses that attempt to explain the success of invasive exotic species. One of them is that degraded environments are facilitators of BI (Williamson 1996). In addition, the production of large amounts of propagules, the rapid growth of the root system, adaptation to fire, the ability to interfere with the growth of neighbouring plants, the morphological and physiological similarity with native species, self-pollination and the ability to fix nitrogen by symbiotic bacteria, are characteristics that should contribute to the success of BI processes (Cronk and Fuller 1995). The absence of natural enemies is also another contributing factor, since exotic organisms, in general, are free from predators, competitors and parasites from their region of origin (Ziller 2001).

Knowing the threats that BI can cause to biodiversity and to productive sectors of society, the topic was discussed globally for the first time at ECO-Rio 92 (CBD 1992; ONUBR 2020). Years later, the Aichi Goals were created, where it was established by Goal 9 that, by 2020, the signatory countries of the Agreement, should establish measures to prevent the introduction of exotic invaders and that already introduced species should be identified, prioritised and controlled or eradicated (CBD 2020).

Following this movement, in 1996, the Inter-American Biodiversity Information Network (IABIN) was created, which compromises 18 signatory countries, including Brazil (I3N 2020). In addition to the online database that provides a list of its invasive exotic species, here in Brazil, the first federative document directed to the topic was created in 2009. Resolution No. 5 of the National Biodiversity Commission (Brasil 2009), updated in 2018 by Resolution No. 7 (Brasil 2018), outlines the National Strategy on Invasive Exotic Species. The document aims to "Guide the implementation of measures to prevent the introduction and dispersion and significantly reduce the impact of invasive exotic species on Brazilian biodiversity and ecosystem services, to control or eradicate invasive alien species" (Brasil 2018). This document is divided into six components: (1) Legislation, intersectoral articulation and international cooperation; (2) Prevention, early detection and rapid response; (3) Eradication, control and mitigation of impacts; (4) Scientific research; (5) Technical training; (6) Environmental Education and Communication.

According to Objective 2.1 of component 2, it is necessary to update the survey and identify the invasive exotic species present in the country (Brasil 2018). Still, according to this objective, it is only after the identification of these species that it is possible to define preventative measures against them. Thus, inventories of these taxa should be performed in order to identify their occurrence in different ecosystems, since these can not only provide subsidies for projects aimed at prevention of environmental impacts caused by exotic species, but also for conservation plans (Ziller 2016). Despite the evident importance of exotic species lists, only Paraná, Santa Catarina, Rio Grande do Sul and São Paulo published official lists (MMA 2020). However, it is worth noting the growth in research related to the theme in recent years (Ziller 2001; Nunes et al. 2018).

In front of the impacts that these taxa can cause and the absence of a species list for Sergipe, the present study sought to answer the following questions: I. What are the non-native species with potential invasion that occur in Sergipe; II. What is the habit of these species; III. What is the origin of these species; and IV. In which biomes/ecosystems can they be found? Thus, this work aimed to carry out the floristic survey of non-native plants with potential for invasion to Sergipe, Brazil.

Material and methods

The State of Sergipe, located in north-eastern Brazil, has an area of 21,910 km^2 (Prata et al. 2013). Its vegetation is composed of Atlantic Forest and Caatinga biomes, both intensely fragmented and degraded (Ferrari 2005; Prata et al. 2013). The State has three climatic types according to the Köppen-Geiger classification: tropical with dry summer (As) in northern coast and central State, tropical monsoon (Am) in the south coast and semi-arid (BSh) in the west (Alvares et al. 2013).

For this study, 100 expeditions were carried out to sites under the domains of Caatinga, Atlantic Forest, Sandbank and Mangrove in 23 municipalities in the State of Sergipe (Fig. 1). The average duration of each expedition was 4 hours. The studied sites are represented by conservation units (PARNA Serra de Itabaiana, APA Morro do Urubu, APA Litoral Sul, APA Litoral Norte and MONA Grota do Angico), fragments of native properties vegetation agricultural environments (areas of cultivation and pastures), vacant lots and margins of highways and roads.

The species inventory was carried out by means of walks along the entire extension of the places (active search) where samples of fertile material from the plants were collected according to Mori et al. (1989). After collection, this material was herborised and deposited at the Herbarium ASE (Thiers 2020) of the Federal University of Sergipe, São Cristóvão, SE. With this, each plant deposited in the herbarium ASE was registered by receiving a voucher. The taxonomic categories are in accordance with APG IV (2016) and the spelling of the authors' names according to the IPNI – International Plant Names Index (2020).

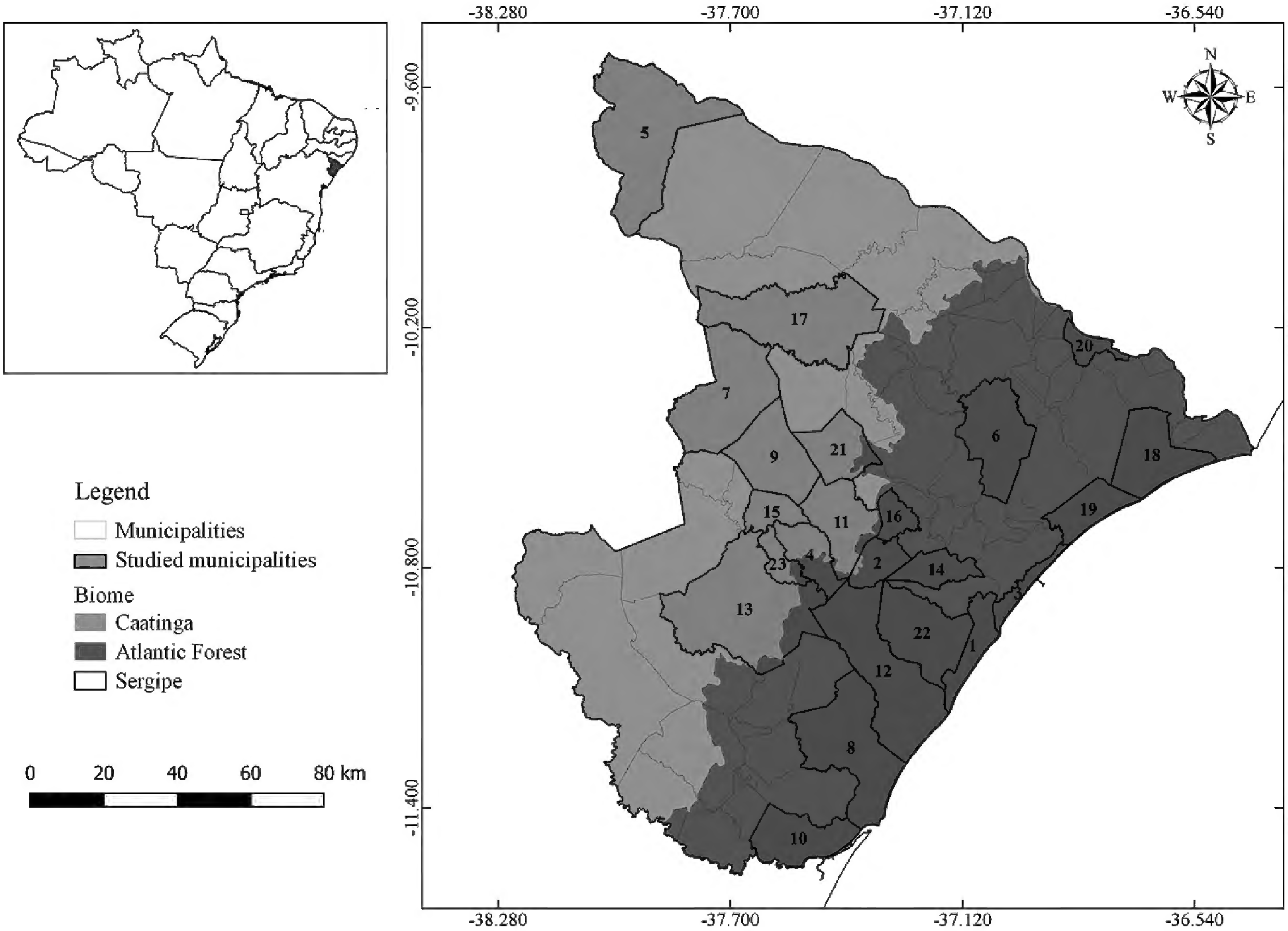

Figure 1. Municipalities where expeditions were carried out to survey plant species with potential to invade the State of Sergipe, Brazil. 1 – Aracaju; 2 – Areia Branca; 3 – Barra dos Coqueiros; 4 – Campo do Brito; 5 – Canindé de São Francisco; 6 – Capela; 7 – Carira; 8 – Estância; 9 – Frei Paulo; 10 – Indiaroba; 11 – Itabaiana; 12 – Itaporanga D'ajuda; 13 – Lagarto; 14 – Laranjeiras; 15 – Macambira; 16 – Malhador; 17 – Nossa Senhora da Glória; 18 – Pacatuba; 19 – Pirambu; 20 – Propriá; 21 – Ribeirópolis; 22 – São Cristóvão; 23 – São Domingos.

The habit (herbs, lianas, palms, shrub and trees) of the plants was defined through observations made in the field and by consulting Flora do Brasil (2020). The origins of the inventoried species were determined by consulting specialised databases (BioNET-EAFRINET 2020; CABI 2020; I3N 2020; ISSG 2020) and scientific articles.

With the list of species, those categorised as non-native, were separated and those with invasive potential (naturalised and exotic invaders) were used to prepare the present study. The definition of naturalised and exotic invasive species used here is based on the work of Richardson et al. (2000), where they consider non-native species that reproduce and form stable populations only in the place where they were introduced and exotic invaders, those that reproduce, disperse and establish themselves in places far from the place of introduction. The classification of the species in naturalised and exotic was made by in situ observations and by consulting the specialised database (BioNET-EAFRINET 2020; CABI 2020; I3N 2020; ISSG 2020). Bar graphs were made using "ggplot2" package (Wickham 2016) and the Venn Dia-

gram was created using "VennDiagram" package (Chen and Boutros 2011), both figures being made using the software R (R Core Team 2020). The data underpinning the analysis reported in this paper are deposited at GBIF, the Global Biodiversity Information Facility, and are available at https://doi.org/10.15468/6mdt5d.

Results

Altogether, 83 non-native species with invasion potential were sampled in the State of Sergipe, of which 73 were found in the Atlantic Forest domains, 43 in the Caatinga, 36 in Sandbank and 22 in the Mangrove (Table 1). From these species, 17 were inventoried in all the biomes/ecosystems studied and 35 were observed in only one of them, 26 in the Atlantic Forest, six in the Caatinga and three in Sandbank (Fig. 2).

The sampled species belonged to 29 botanical families. The families with the highest number of records were Poaceae with 20 species (23.4%), followed by Fabaceae with six (7.1%), Asparagaceae, Cucurbitaceae and Myrtaceae with five (5.9%), Apocynaceae and Asteraceae with four (4.7%). The other families presented three, two or just one recorded species (Fig. 3B).

Regarding the origin of the species, 22 were African species, 12 Asian and 15 species originated in the continents of Africa and Asia, six species originated in North America, while Central America, South America and Oceania presented only three species each. In addition, 19 other species had two or more continents as their origin (Fig. 3B). Regarding the habit of species, the most abundant group was the herbs with 43 (51.2%) representatives, followed by trees with 18 (21.42%), shrubs with 12 (14.28%), lianas with nine (10.71%) and palm trees with only one species (1.19%) (Fig. 3C; Table 2).

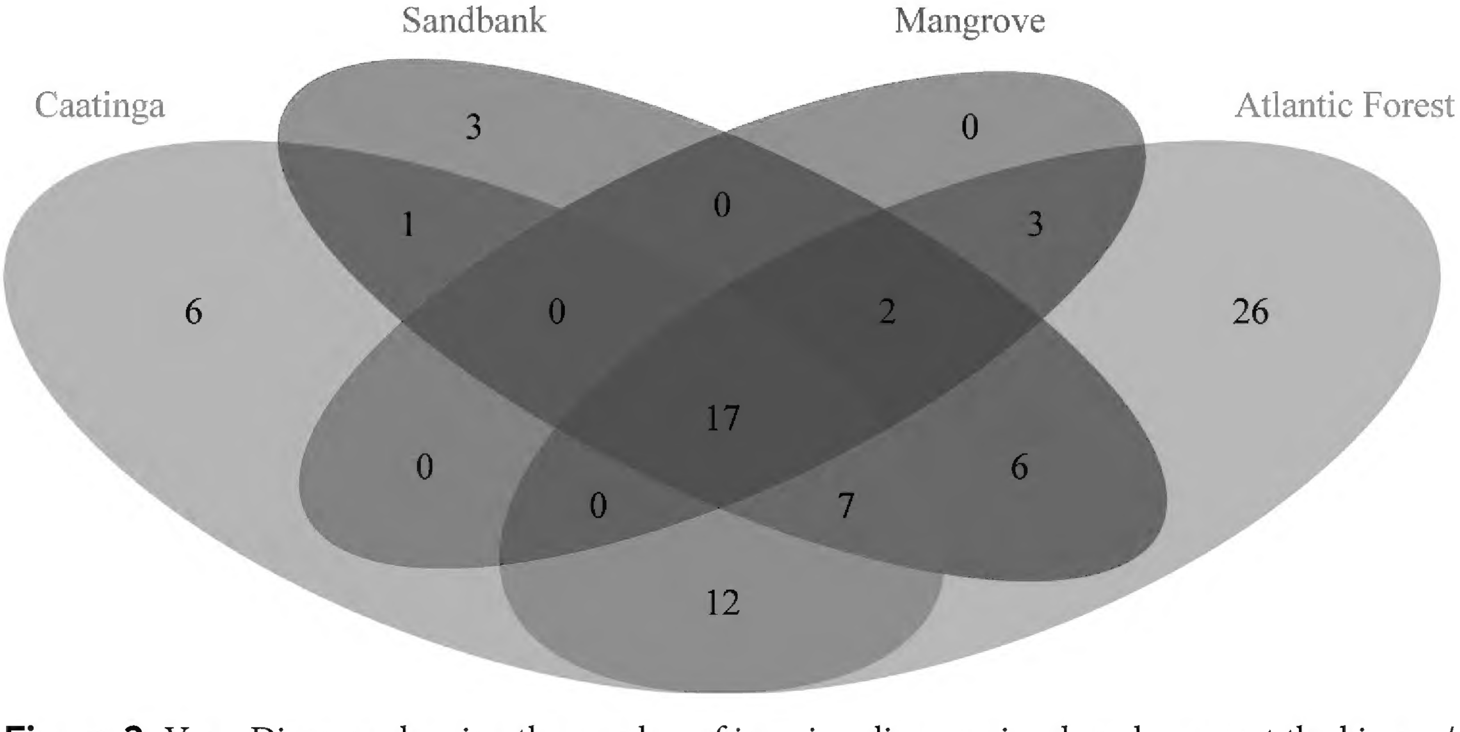

Figure 2. Venn Diagram showing the number of invasive alien species shared amongst the biomes/ecosystems of the State of Sergipe in northeast Brazil.

Table 1. List of alien species sampled by biome/ecosystem in Sergipe, Brazil. 0: absence; 1: presence. Af = Atlantic Forest; Ca = Caatinga; Ma = Mangrove; Sa = Sandbank. Vouchers of herbarium ASE, Federal University of Sergipe, São Cristóvão, SE. * = Species not collected due to lack of fertile material.

Family/Species	Ca	Af	Sa	Ma	Voucher
Acanthaceae Juss.					
Asystasia gangetica (L.) T. Anderson	0	1	0	1	37616
Dyschoriste depressa Nees	0	1	0	0	39688
Amaranthaceae A. Juss.					
Amaranthus viridis L.	1	1	1	1	37621
Chenopodium murale L.	1	1	0	0	*
Anacardiaceae R. Br.					
Mangifera indica L.	0	1	1	0	36980
Apocynaceae Juss.					
Calotropis procera (Aiton) W.T. Aiton	1	0	1	0	36968
Catharanthus roseus (L.) G. Don	1	1	0	0	41924
Cryptostegia madagascariensis Bojer	1	1	1	0	39879
Thevetia peruviana (Pers.) K. Schum.	0	1	0	0	37380
Araceae Juss.					
Dieffenbachia seguine (Jacq.) Schott	0	1	0	0	*
Syngonium angustatum Schott	0	1	0	0	37382
Xanthosoma sagittifolium (L.) Schott	0	1	0	0	37373
Arecaceae Schultz Sch.					
Elaeis guineensis Jacq.	0	1	0	0	*
Asparagaceae Juss.					
Agave angustifolia Haw.	1	1	0	0	*
Agave sisalana Perrine ex Engelm.	1	1	1	0	38464
Dracaena fragrans (L.) Ker Gawl.	0	1	0	0	37376
Furcraea foetida (L.) Haw.	1	0	0	0	*
Sansevieria trifasciata Prain	0	1	0	0	37374
Asteraceae Bercht. & J. Presl					
Cosmos caudatus Kunth	0	1	0	0	*
Cosmos sulphureus Cav.	0	1	0	0	*
Sonchus asper (L.) Hill	0	1	0	0	*
Tithonia diversifolia (Hemsl.) A. Gray	0	1	0	0	*
Cactaceae Juss.					
Opuntia stricta (Haw.) Haw.	0	0	1	0	37623
Casuarinaceae R.Br					
Casuarina equisetifolia L.	0	1	1	0	36982
Combretaceae R.Br.					
Terminalia catappa L.	1	1	1	1	37617
Commelinaceae Mirb.					
Commelina benghalensis L.	1	1	1	1	36971
Tradescantia zebrina Heynh. ex Bosse	0	1	0	0	*
Convolvulaceae Juss.					
Ipomoea nil (L.) Roth	0	1	0	0	39694
Crassulaceae J.St.-Hil.					
Kalanchoe delagoensis Eckl. & Zeyh.	0	1	0	0	*
Kalanchoe mortagei Raym. -Hamet & H. Perrier	0	1	0	0	*
Kalanchoe pinnata (Lam.) Pers.	0	1	0	0	*
Cucurbitaceae Juss.					
Citrullus lanatus (Thunb.) Matsum. & Nakai	1	1	0	0	*
Cucumis anguria L.	1	1	0	0	*
Luffa cylindrica (L.) M. Roem.	1	1	1	0	38450
Momordica charantia L.	1	1	1	1	36979
Cyperaceae Juss.					
Cyperus rotundus L.	1	1	1	1	36975
Euphorbiaceae Juss.					
Euphorbia tirucalli L.	1	0	0	0	*
Jatropha gossypiifolia L.	1	1	1	1	37622

Family/Species	Ca	Af	Sa	Ma	Voucher
Ricinus communis L.	1	1	1	1	37619
Fabaceae Lindl.					
Acacia mangium Willd.	0	1	1	0	*
Crotalaria pallida Aiton	0	1	1	0	*
Crotalaria retusa L.	0	1	1	0	36999
Leucaena leucocephala (Lam.) de Wit	1	1	1	1	37618
Pithecellobium dulce (Roxb.) Benth.	0	1	1	1	39699
Prosopis spp.	1	0	0	0	36978
Lamiaceae Martinov					
Leonotis nepetifolia (L.) R. Br.	1	1	1	0	*
Malvaceae Juss.					
Talipariti tiliaceum (L.) Fryxell	0	0	1	0	39807
Thespesia populnea (L.) Sol. ex Corrêa	0	1	0	1	36977
Meliaceae A. Juss.					
Azadirachta indica A. Juss.	1	1	1	1	37620
Moraceae Gaudich.					
Artocarpus heterophyllus Lam.	0	1	0	0	*
Myrtaceae Juss.					
Eucalyptus spp.	0	1	0	0	*
Psidium guajava L.	0	1	1	0	*
Syzygium cumini (L.) Skeels	0	1	0	1	38454
Syzygium jambos (L.) Alston	0	1	0	0	39885
Syzygium malaccense (L.) Merr. & L.M. Perry	0	1	0	0	*
Nyctaginaceae Juss.					
Boerhavia diffusa L.	1	1	1	1	36974
Mirabilis jalapa L.	0	1	0	0	*
Papaveraceae Juss.					
Argemone mexicana L.	1	1	0	0	*
Poaceae Barnhart					
Aristida adscensionis L.	1	0	0	0	38453
Arundo donax L.	0	1	1	1	*
Cenchrus ciliaris L.	1	1	0	0	*
Cenchrus echinatus L.	1	1	1	1	36969
Cenchrus polystachios (L.) Morrone	1	1	0	0	*
Cenchrus purpureus (Schumach.) Morrone	0	1	0	0	*
Cynodon dactylon (L.) Pers.	1	1	1	1	37624
Dactyloctenium aegyptium (L.) Willd.	1	1	1	1	36973
Echinochloa colona (L.) Link	1	1	0	0	41904
Eleusine indica (L.) Gaertn.	1	1	1	0	41940
Eragrostis ciliaris (L.) R. Br.	1	1	1	0	37630
Eragrostis pilosa (L.) P. Beauv.	1	1	1	1	41908
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	1	1	1	1	36981
Megathyrsus maximus (Jacq.) B.K. Simon & S.W.L. Jacobs	1	1	1	1	39883
Melinis minutiflora P. Beauv.	0	1	0	0	42075
Melinis repens (Willd.) Zizka	1	1	1	1	39703
Sorghum bicolor subsp. *arundinaceum* (Desv.) de Wet & J.R. Harlan	1	1	1	0	*
Tragus berteronianus Schult.	1	0	0	0	*
Urochloa brizantha (Hochst. ex A. Rich.) R.D. Webster	0	1	0	0	37629
Urochloa mosambicensis (Hack.) Dandy	1	1	0	0	37628
Polygonaceae A. Juss.					
Antigonon leptopus Hook. & Arn.	0	1	0	0	39695
Rubiaceae Juss.					
Morinda citrifolia L.	0	0	1	0	*
Solanaceae A. Juss.					
Nicandra physalodes (L.) Gaertn.	1	1	0	0	41880
Nicotiana glauca Graham	1	0	0	0	42083
Physalis angulata L.	1	1	0	0	36997
Total	43	73	36	22	

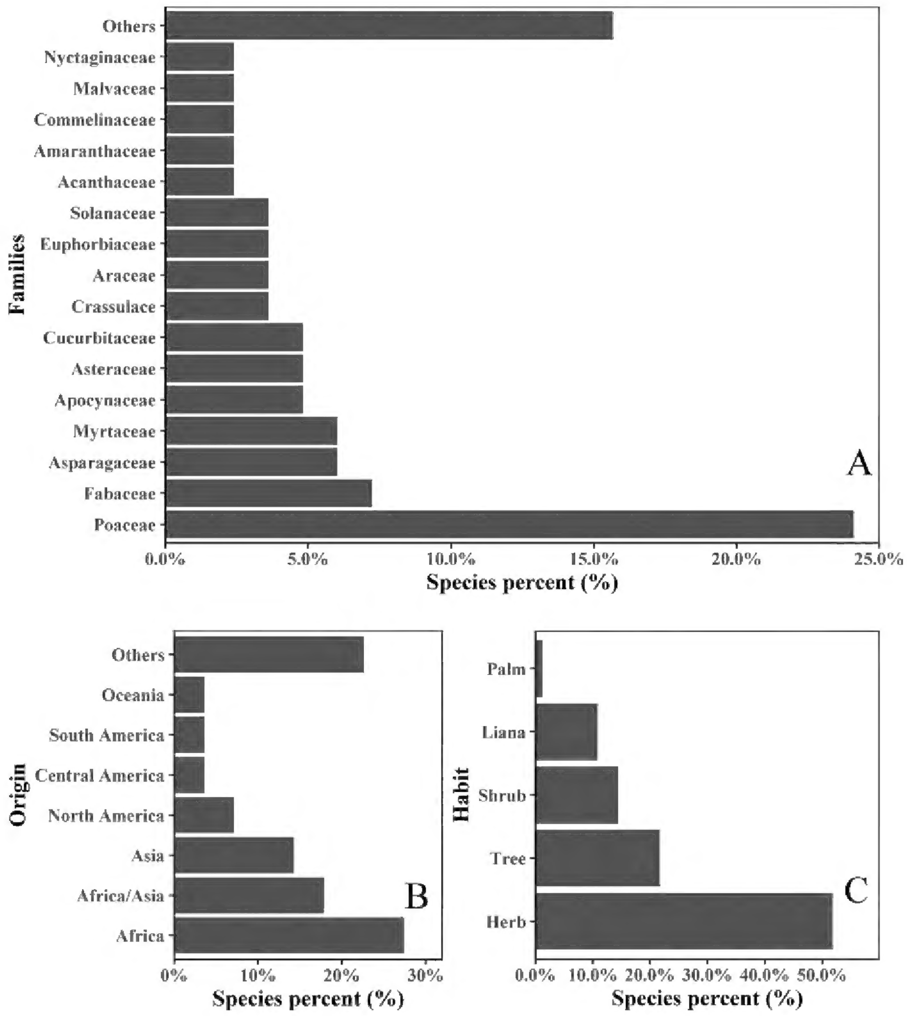

Figure 3. Records of invasive exotic species in the State of Sergipe, Brazil: number of species per family (**A**), number of species by origin (**B**), number of species recorded for each habit (**C**). In (**A**), the term "others" indicates families with only one recorded species; in (**C**), "other" indicates that the species has two or more continents as origin (see Table 2).

Table 2. Habit and origin of alien species sampled in Sergipe, Brazil. H = herb; L = Liana; P = palm; S = shrub; T = tree.

Specie	Habit	Origin
Acacia mangium Willd.	T	Africa; Asia
Agave angustifolia Haw.	H	Mexico
Agave sisalana Perrine ex Engelm.	H	Mexico
Amaranthus viridis L.	H	Central America
Antigonon leptopus Hook. & Arn.	L	Mexico
Argemone mexicana L.	H	Mexico; Central America
Aristida adscensionis L.	H	Canary Islands
Artocarpus heterophyllus Lam.	T	India; Malaysia
Arundo donax L.	H	Asia
Asystasia gangetica (L.) T. Anderson	L	India; Malaysia; Asia; Africa
Azadirachta indica A. Juss.	T	India
Boerhavia diffusa L.	H	India
Calotropis procera (Aiton) W.T. Aiton	S	Africa; Asia
Casuarina equisetifolia L.	T	Asia
Catharanthus roseus (L.) G. Don	H	Madagascar
Cenchrus ciliaris L.	H	Africa; Asia
Cenchrus echinatus L.	H	Central America
Cenchrus polystachios (L.) Morrone	H	Africa; Asia
Cenchrus purpureus (Schumach.) Morrone	H	Africa
Chenopodium murale L.	H	Europa; Asia; Africa
Citrullus lanatus (Thunb.) Matsum. & Nakai	L	Africa
Commelina benghalensis L.	H	Africa; Asia
Cosmos caudatus Kunth	H	Central America

Specie	Habit	Origin
Cosmos sulphureus Cav.	H	Madagascar
Crotalaria pallida Aiton	S	Africa
Crotalaria retusa L.	S	Africa; Asia
Cryptostegia madagascariensis Bojer	L	Madagascar
Cucumis anguria L.	L	Africa
Cynodon dactylon (L.) Pers.	H	Africa; Asia; Europa
Cyperus rotundus L.	H	India; Africa
Dactyloctenium aegyptium (L.) Willd.	H	Africa; Asia
Dieffenbachia seguine (Jacq.) Schott	S	Americas
Dracaena fragrans (L.) Ker Gawl.	S	Western Africa
Dyschoriste depressa Nees	S	South Africa
Echinochloa colona (L.) Link	H	Asia; Europa
Elaeis guineensis Jacq.	P	Africa
Eleusine indica (L.) Gaertn.	H	Africa; Asia
Eragrostis ciliaris (L.) R. Br.	H	Africa
Eragrostis pilosa (L.) P. Beauv.	H	Europa; Africa
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult	H	Africa; Asia
Eucalyptus spp.	T	Australia
Euphorbia tirucalli L.	S	Africa; India
Furcraea foetida (L.) Haw.	H	Central America; North of South America
Ipomoea nil (L.) Roth.	L	Asia
Jatropha gossypiifolia L.	S	Tropical America
Kalanchoe delagoensis Eckl. & Zeyh.	H	Madagascar
Kalanchoe mortagei Raym. -Hamet & H. Perrier	H	Madagascar
Kalanchoe pinnata (Lam.) Pers.	H	Africa
Leonotis nepetifolia (L.) R. Br.	H	Africa; Asia
Leucaena leucocephala (Lam.) de Wit	T	Mexico
Luffa cylindrica (L.) M.Roem.	L	Africa; Asia
Mangifera indica L.	T	India; Asia
Megathyrsus maximus (Jacq.) B.K. Simon & S.W.L. Jacobs	H	Africa
Melinis minutiflora P. Beauv.	H	Africa
Melinis repens (Willd.) Zizka	H	Africa
Mirabilis jalapa L.	S	Tropical America
Momordica charantia L.	L	Asia
Morinda citrifolia L.	T	Asia; Australia
Nicandra physalodes (L.) Gaertn.	H	Peru
Nicotiana glauca Graham	S	Argentina; Bolivia
Opuntia stricta (Haw.) Haw.	S	Central America
Physalis angulata L.	H	Australia; Tropical America
Pithecellobium dulce (Roxb.) Benth.	T	Mexico
Prosopis spp.	T	Americas
Psidium guajava L.	T	North America
Ricinus communis L.	S	Africa; Asia
Sansevieria trifasciata Prain	H	Africa
Sonchus asper (L.) Hill	H	Oceania
Sorghum bicolor subsp. *arundinaceum* (Desv.) de Wet & J.R. Harlan	H	Africa
Syngonium angustatum Schott	L	Central America
Syzygium cumini (L.) Skeels	T	Asia
Syzygium jambos (L.) Alston	T	Asia
Syzygium malaccense (L.) Merr. & L.M. Perry	T	Asia
Talipariti tiliaceum (L.) Fryxell	T	Polynesia
Terminalia catappa L.	T	India; Malaysia; Asia
Thespesia populnea (L.) Sol. ex Corrêa	T	Asia
Thevetia peruviana (Pers.) K. Schum.	T	Central and North America; India
Tithonia diversifolia (Hemsl.) A. Gray	H	Mexico; Central America
Tradescantia zebrina Heynh. ex Bosse	H	Mexico; Central America
Tragus berteronianus Schult.	H	Asia; Africa
Urochloa brizantha (Hochst. ex A. Rich.) R.D. Webster	H	Africa
Urochloa mosambicensis (Hack.) Dandy	H	Africa
Xanthosoma sagittifolium (L.) Schott	H	South America

Discussion

The number of plant species with invasive potential sampled in Sergipe is alarming, because it exceeds the values found in states with much larger territories, such as Santa Catarina (39 spp.), Rio Grande do Sul (44 spp.) and Paraná (72 spp.) (Brasil 2013; Instituto Hórus 2016; Ziller 2016). In addition, our list had almost twice as many species when compared to the study carried out by Leão et al. (2011) throughout north-eastern Brazil. It should also be noted that 52 species on our list were not mentioned in former studies.

In addition to our high sampling effort, the storage conditions of the biomes/ecosystems in Sergipe should explain the large number of taxa sampled here. Sergipe is considered the most degraded State in north-eastern Brazil (Ferrari 2005). Until the beginning of the 21st century, about 41% of the State had plant cover (Campos 1912), whereas, currently, there is only 13% natural forest cover (SEMARH-SE 2014).

The highest abundance of non-native invasive species with potential in the Atlantic Forest may be the result of strong environmental degradation which conditioned such biome (Myers et al. 2000; Tabarelli et al. 2005; INPE 2017). Degraded environments are more susceptible to the invasion process (Azevedo et al. 2010) and because of this, they tend to have a high dominance of exotic species (Huston 2004). According to Davis (2009), environmental degradation facilitates the invasion process, reducing competition and increasing the availability of resources.

Most of the species sampled by us are r-strategists, that is, they make pioneering use of the soil, have a short germination time, high growth rates and small size (Rejmánek and Richardson 1996). These attributes seem to be very important for the success of invasive alien species, since the same has also been observed in other studies (Horowitz et al. 2014; Fabricante et al. 2015; Galasso et al. 2018; Alves and Fabricante 2019; Silva and Fabricante 2019).

In Sergipe, the Atlantic Forest has been reduced to just 8% of its original area (Santos 2009), which is quite worrying since this biome is considered a priority area for biodiversity conservation – a hotspot (Myers et al. 2000). The condition of the Caatinga biome in the State is in a similar situation. It has been drastically reduced due to the exploration and use of its areas for crops and pastures (Arruda 2001).

The predominance of species belonging to the botanical family Poaceae and Fabaceae is due to the intrinsic characteristics of the taxa of these groups. Many of these species have an efficient dispersion system, form large seed-banks and have allelochemicals in their tissues (GISP 2005; Leão et al. 2011; Fabricante 2014). In addition, several of these species have been introduced massively to serve as fodder, especially in semi-arid regions (GISP 2005; Leão et al. 2011). Species, such as *Prosopis juliflora* (Sw.) DC. and *Leucaena leucocephala* (Lam.) de Wit, for example, exhibit drought resistance, high production of propagules and palatable parts, that is, characteristics that increase the invasive potential of species (Williams and Baruch 2000; Arriaga et al. 2004; CABI 2020).

Other floristic surveys of non-native species carried out in Caatinga sites also demonstrated a predominance of herbaceous species (Fabricante et al. 2015; Alves

and Fabricante 2019; Silva and Fabricante 2019). In the Atlantic Forest, woody species predominated (Souza et al. 2011; Mielke et al. 2015; Petri et al. 2018). Both situations corroborate our results. The edaphoclimatic conditions of biomes must favour certain extracts of vegetation (IBGE 2012; IFN 2017). Many herbaceous species were introduced into Brazil for human or animal food (Zenni 2014). Thus, it is expected that this habit will be prevalent in large-scale studies, such as this one.

The facilitation in the transfer of species that has occurred in recent years due to globalisation and advances in transport technologies (GISP 2005; Lockwood et al. 2007), associated with the market and people's interest in non-native species, may explain the existence of plants from different parts of the world found in our study. Most of these species were intentionally introduced into Brazil and other parts of the world, as they have different attributes, such as ornamentals, food, fuel production, fodder, amongst others (GISP 2005; Leão et al. 2011; Sampaio and Schmidt 2014; Zenni 2014).

Moreover, the high number of species of African origin can be justified by the climatic and biophysical similarities with Brazilian regions (GISP 2005; Herrera et al. 2016). According to Pérez et al. (2006) and Facon et al. (2006), the invasive potential of a species is intensified when the place of introduction has environmental conditions similar to its place of origin. In addition, a huge number of studies have already demonstrated through niche modelling that several invasive exotic species originating in Africa have great potential for invasion in Brazilian regions, including Sergipe (Araújo et al. 2013; Fabricante 2013; Alves et al. 2014; Herrera et al. 2016; Santos and Fabricante 2018).

The results presented here indicated a large number of non-native species with invasive potential and the existence of recognised aggressive species (e.g. *Prosopis juliflora* (Sw.) DC., *Leucaena leucocephala* (Lam.) de Wit, *Artocarpus heterophyllus* Lam., *Ricinus comunis* L., *Calotropis procera* (Aiton) WT Aiton, *Terminalia catappa* L., *Boerhavia diffusa* L., *Cyperus rotundus* L., *Azadirachta indica* A. Juss., *Psidium guajava* L.). Such results may stimulate new studies, as well as serve as an aid to management, decision-making and the creation of public policies in the State.

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